

Example #5: A 0.0030 kg bullet travelling with a velocity of 800. m/s is fired into a 0.50 kg box of sand that is at rest on a horizontal, frictionless surface. The bullet passes through the sand and emerges with a velocity of 200. m/s at the other side.

- a) Find the impulse delivered to the sand.
- b) Find the velocity of the box of sand after the collision.
- c) If the bullet was inside the box for 0.020 s, find the average force exerted on the block.

$$\begin{aligned} \text{a) } \Delta p &= m(v_f - v_i) \\ &= .0030(200 - 800) \end{aligned}$$

$$\boxed{\Delta p = -1.8 \frac{\text{kg} \cdot \text{m}}{\text{s}}}$$

b) impulse lost by bullet = impulse gained by block

$$\therefore \Delta p_{\text{sand}} = 1.8 \frac{\text{kg} \cdot \text{m}}{\text{s}}$$

$$\Delta p = m(v_f - v_i) \quad 1.8 = .50(v_f - 0)$$

$$\boxed{v_f = 3.6 \text{ m/s}}$$

$$\text{c) } \Delta p = Ft \quad 1.8 = F(.020)$$

$$\boxed{F = 90 \text{ N}}$$